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2209969

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Health Consultation

ELKTON FARM FIREHOLE SITE

ELKTON, CECIL COUNTY, MARYLAND

EPA FACILITY ID: MDN000306146

DECEMBER 22, 2005

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES

Public Health Service

Agency for Toxic Substances and Disease Registry

Division of Health Assessment and Consultation

Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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HEALTH CONSULTATION

ELKTON FARM FIREHOLE SITE

ELKTON, CECIL COUNTY, MARYLAND

EPA FACILITY ID: MDN000306146

Prepared by:

**Division of Regional Operations
Agency for Toxic Substances and Disease Registry
The U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry
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Background and Statement of Issues

In April 2005, the Agency for Toxic Substances and Diseases Registry (ATSDR) was requested by the U.S. Environmental Protection Agency (EPA) Region 3 to evaluate the potential public health impact of explosives-contaminated environmental media under current and future use scenarios at the Elkton Farm Superfund site. ATSDR was asked to specifically focus on environmental data from the portion of the property near the former "Firehole" in this evaluation.

Contaminants of concern at this site include explosives contaminants such as 2,4,6-trinitrotoluene (TNT) and its degradation products. Currently, the site is used for farming. EPA requested ATSDR to determine if the contamination poses a public health threat for people or animals consuming the crops from the property. In the future, the site is proposed for residential development. EPA additionally requested ATSDR to determine if the contamination might pose a future public health threat for people who live near or on the property.

EPA is working with the Maryland Department of the Environment (MDE) to complete a pre-remedial evaluation of the Elkton Farm Site. The Elkton Farm Site is located in a rural area two miles southwest of Elkton, Maryland near the intersection of Routes 40 and 279. The street address is approximately 183 Zeitler Road. The Elkton Farm property lies at the confluence of Little Elk Creek with Laurel Run. Natural drainage on the site is in a generalized north to south direction. There is a slight drainage divide on the property that directs surface runoff to either Laurel Run or Little Elk Creek.

The contaminated Firehole portion of the site consists of a series of burn pits located across approximately 32 acres of the overall 400-acre Elkton Farm. Figures 1 and 2 depict sampling locations from various recent sampling events at the Firehole portion of the site. Figure 3 contains photographs of the Firehole area.

Portions of the site have functioned as a working farm. However, during the decade before and during World War II, portions of the property were also used for the burning and disposal of munitions. During the 1970s, hazardous material was stored and disposed of on the farm. Four areas affected by the historical hazardous materials activities have been identified across the entire 400-acre site. Unit 1 is an area of the farm that was used by a property owner for the storage and disposal of hazardous and non-hazardous waste, including waste ordnance and drums of ash. This unit was addressed by a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) cleanup in the early 1990s. Unit 2 is the approximately 32 acres that contains a series of waste combustion pits known as the Firehole. Unit 3 is a 1-acre plot leased by Thiokol as a rocket motor testing and recovery area. Unit 4 is an area where waste organic solvents may have been disposed of on the property.¹ This health consultation focuses on data available from Unit 2, the 32-acre Firehole portion of the site (see Figures 1-4).

Site Visit

ATSDR staff, the EPA Region 3 Site Assessment Manager, and the MDE Project Manager visited the site on June 8, 2005 to observe current site conditions and identify the location of the various media sampling points in the Firehole area. Data available for this portion of the site include surface soil, groundwater, surface water, and sediment data. ATSDR staff re-visited the

site on July 25, 2005 to observe the status of the ongoing removal action at this site.

Discussion

Data review

There were several recent rounds of sampling from the Firehole portion of this site. ATSDR reviewed 14 surface soil samples, 10 subsurface samples, 6 surface water samples, and 6 sediment samples collected in October 2002 (see Figure 1); 5 groundwater samples from site monitoring wells and a water sample from a domestic well collected in May 2003 (see Figure 1); 12 surface and 12 subsurface soil samples collected in December 2004 and January 2005 (see Figure 2); and 18 soil samples (analyzed for nitroaromatic compounds only) collected in March 2005. ATSDR focused on the surface soil samples for future exposures in this evaluation, as opposed to the subsurface samples from depths, because surface soil samples are the most indicative of actual public health exposures from direct contact. The conclusions in this report depend on the availability and reliability of the data that were reviewed.

ATSDR screened the sampling results from the Firehole portion of the site by comparing data from the site to environmental guideline comparison values (CVs). CVs are established on the basis of a review of toxicology literature for a given substance. Many uncertainty factors are included when these values were developed, making them very conservative (i.e., protective of public health). Exposure to a chemical below its corresponding CV indicates that adverse health effects are unlikely, however, exposure above its corresponding CV *does not* indicate that adverse health effects will occur. Additional evaluation is needed if chemicals are found at levels above their corresponding environmental CVs.

Perchlorate, a contaminant of concern at some ordnance-related Formerly Utilized Defense (FUD) sites, was not detected in any of the samples from the Firehole portion of this site.

The following paragraphs describe the results of ATSDR's screening of the Firehole area sampling data. Table 1 summarizes the maximum contaminant levels in *groundwater* that exceeded comparison values across the recent sampling events at the Firehole. Table 2 summarizes the maximum contaminant levels in *surface soil* that exceeded comparison values across the recent sampling events at the Firehole.

In October 2002, MDE collected 14 surface soil samples, 10 subsurface soil samples, 6 surface water samples, and 6 sediment samples from the Firehole area and analyzed these samples for metals and cyanide, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides and polychlorinated byphenyls (PCBs), perchlorates, and nitroaromatic compounds.

- The highest detections of inorganics, VOCs, SVOCs, and nitroaromatic compounds in the surface soil samples were found at sampling locations S13 and S14. S13 and S14 were obtained directly from burn pits within the Firehole area. The following sub bullets describe the contaminants found above comparison values in the surface soil samples from this sampling round.
 - Two pesticide concentrations (toxaphene at 610 parts per billion (ppb) at S12 and

DDT at 1,400+ ppb at S13) in the surface soil slightly exceeded or approached health-based screening levels. Sample S5, which was a duplicate of S12, did not have the same detections of pesticides as S12.

- Of the 14 soil samples, only one sample exceeded a health-based screening level for lead in residential surface soil; lead was detected in S14 at 1,480 parts per million (ppm). The next two highest results were at S13 at 305 ppm and S8 at 142 ppm, and the remaining soil samples ranged from 12.3-49.4 ppm.
- Cadmium was elevated at S14, and this concentration (12.5 ppm) slightly exceeded a child chronic health-based screening level.
- Arsenic levels in surface soil ranged from 2.7 – 5.6 ppm; these levels slightly exceed a chronic cancer health-based screening value. However, these arsenic levels are within the normal background range for this area (the arsenic level in a background sample taken for this site was 2.7 ppm) and do not appear to be elevated from site-related activities.
- Nitroaromatic compounds (1,3,5-trinitrobenzene, 2,4,6-trinitrotoluene, 4-amino 2,6-dinitrotoluene, 2-amino 4,6-dinitrotoluene and dinitrotoluene mix) were detected in surface soil samples S3, S6, S8, S13, and S14. However, only one sample exceeded health-based screening levels for dinitrotoluene compounds (S6 had 1,530 ppb of 4-amino 2,6-dinitrotoluene and 1,260 ppb of 2-amino 4,6-dinitrotoluene).
- All of the reported levels in sediment and surface water samples were below screening values. The majority of these samples were taken from Laurel Run, although one surface water sample (SW4) and one sediment sample (SED4) were taken from Little Elk Creek. One of the sediment samples (SED5) from the Laurel Run confluence had detections of all inorganic compounds above background, but below health-based screening values for human dermal/ingestion contact with this sediment.²

In May 2003, MDE collected five groundwater samples from site monitoring wells and analyzed them for total and dissolved metals, VOCs, SVOCs, pesticides and PCBs, nitroaromatic compounds, and perchlorates. In a related investigation for this site, MDE also collected a water sample from a private domestic well located at a farmhouse on the site.

- Health-based screening levels for two VOCs were exceeded in both the sample and the duplicate sample taken from the onsite groundwater monitoring well (MW-2). Trichloroethylene (TCE) was detected at 190 ug/L and 170 ug/L, and 1,1,2-trichloroethane (TCA) was detected at 2 ug/L and 0.6 ug/L.
- None of the metals were above screening levels in the filtered groundwater samples.
- Levels of arsenic, lead, and manganese exceeded health-based screening values in the total metals analysis of a few of the groundwater samples.
 - The highest level of total manganese (1,250 ug/L) was detected in the background monitoring well sample (MW-1).
 - Arsenic was detected at approximately 6 ug/L in MW-3 and below the detection limit in the remaining total metals analyses.
 - Lead was detected from 11 – 28.5 ug/L in the total analyses, with the highest level found in the background monitoring well sample MW-1.
- A trace level (below a health-based screening value) of 4-amino-2,6-dinitrotoluene (.015

- ug/L) was also detected in one of the two samples from MW-2.
- No perchlorates were detected in any of the groundwater samples.³
- No results were above health-based screening values in the groundwater sample taken from the private domestic well on the site.⁴

Further surface and subsurface soil sampling at the site was conducted in 2004 and 2005 to evaluate the areas within the suspected Firehole for munitions-related contamination. In December 2004 and January 2005, 12 surface soil samples and 12 subsurface soil samples were collected and analyzed for inorganics, organics, perchlorates, and nitroaromatic compounds.

- For the inorganics analysis of the surface soil samples, arsenic, lead, and cadmium levels exceeded health-based screening levels in some of the samples. The highest concentrations in this sampling round for these three metals were reported at S2.
 - Arsenic concentrations ranged from 3-9.5 ppm. Again, these arsenic levels are within the normal background range for this area (the arsenic level in a background sample taken for this site was 2.7 ppm) and do not appear to be elevated from site-related activities.
 - Surface lead concentrations ranged from 295-852 ppm, with higher concentrations at depth (SS12 and its duplicate SS5 recorded 2,620 and 2,860 ppm, respectively).
 - Cadmium levels in this investigation ranged from 6.5-13.6 ppm.⁵
- None of the organics exceeded screening values for the surface soil samples in this sampling event. TCE was detected at low levels (over 1,000 times lower than the screening value) in one surface sample (37 ppb at surface soil sample S1).⁶

In March 2005, and additional 18 soil samples were analyzed for nitroaromatic compounds from the Firehole area.

- Various nitroaromatic compounds (1,3,5-trinitrobenzene, 2,4,6-trinitrotoluene, 4-aminio 2,6-dinitrotoluene, 2-aminio 4,6-dinitrotoluene and other dinitrotoluene isomers) were detected in surface soil samples during this sampling event. During this sampling round, some of the surface soil concentrations exceeded health-based screening levels for TNT and dinitrotoluene at sampling locations S7 and S12. Both of these samples contained such high concentrations of the target analytes that they required dilution for analysis; in particular, the dilution of S7 to bring the TNT concentration into analytical range resulted in other nitrosamine compounds in this sample being diluted below quantitation limits. The TNT concentration at S7 was 1,300 ppm, and at S12 was 192 ppm.⁷

Table 1. Maximum levels of chemicals found in groundwater above CVs at the Elkton Farm Firehole Site

	Sample result (µg/L or ppb)	CV for drinking water (µg/L)	
Trichloroethylene (TCE)	190	5	MCL
1,1,2-trichloroethane	2 (estimated)	200/0.6	MCL/CREG

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(TCA)				
Arsenic		6	10/0.002	MCL/CREG
Manganese		1,250	50	Secondary MCL
Lead		28.5	15/0	EPA Action Level/MCLG
<p>$\mu\text{g/L}$ is micrograms per liter or parts per billion (ppb) : MCL = EPA Maximum Contaminant Level; MCLG = EPA Maximum Contaminant Level Goal; CREG = ATSDR Cancer Risk Evaluation Guideline</p>				

**Table 2. Maximum levels of chemicals found in surface soil above CVs
at the Elkton Farm Firehole Site**

	Sample results (mg/kg or ppm)	CV for soil		
Toxaphene	0.61	0.6	CREG	
DDT	1.4+	1.0	EMEG pica	
4-amino 2,6-dinitrotoluene	1.53	1.0	CREG (for dinitrotoluene mix)	
2-amino 4,6-dinitrotoluene	1.26	1.0	CREG (for dinitrotoluene mix)	
TNT	1,300	20/1	CREG/EMEG pica	
Lead	1,400	400	EPA SSL	
Cadmium	13.6	10	Chronic EMEG, child	
Arsenic	9.5	10/0.5	EMEG pica/CREG	
<i>mg/kg = milligrams per kilogram or parts per million (ppm)</i>				
<i>+= Results reported from 10x diluted analysis</i>				
<i>EMEG pica = ATSDR's environmental media evaluation guide for pica exposures; Chronic EMEG child = ATSDR's environmental media evaluation guideline for exposures greater than 1 year for a pica child; EPA SSL = EPA Soil Screening Level; CREG = ATSDR's cancer risk evaluation guide</i>				

Physical Hazards

Unique physical hazards associated with the Firehole portion of this site are the discarded military materials (e.g., metal parts, mortar primers, and rocket parts) found on the surface and at depth. EPA is using unexploded ordnance (UXO)-qualified contractors during the assessment and cleanup of this portion of the site. As an additional precaution, EPA recently determined that the current winter wheat crop in the Firehole area would remain unharvested to avoid further disturbing the surface and subsurface debris. EPA plans to address the physical hazards in this portion of the site during its current removal action.

Human exposure pathway analysis

ATSDR evaluates whether any completed exposure pathways exist for members of the public and any identified chemicals of concern at a site.

A completed exposure pathway consists of five parts.

1. A source of contamination,
2. movement of the contaminant(s) into and through the environment (in soil, air, groundwater or surface water) to bring it into contact with people,
3. a place where humans could be exposed to the contaminant(s),
4. a way for humans to be exposed to the contaminant(s) (such as by drinking the water or breathing the air), and
5. one or more people who may have contacted the contaminant(s).

Exposure pathways are considered *potential* when one or more of the elements are missing or uncertain but could have existed in the past, could be occurring now, or could exist in the future. Pathways are considered *eliminated* when one or more of these five items do not exist or where conditions make exposures highly unlikely.

For the Firehole portion of this site, ATSDR identified one currently completed exposure pathway (consumption of crops grown at the site) and one potential completed exposure pathway (future residents having contact with contaminated media from the Firehole area, once it is part of the proposed residential development).

Evaluation of Current Crop Consumption Pathway

Winter wheat and soybeans are grown on the property and sold for direct human consumption. Corn is grown on the property for livestock consumption. Actual contamination levels in the crops are not available at this time.

After reviewing the available surface soil data, ATSDR determined that TNT is the primary contaminant of concern for the evaluation of crops grown at this site. Therefore, ATSDR reviewed available scientific literature on uptake of nitrosamine compounds by plants. Plants grown in TNT-contaminated soils and water appear to absorb TNT from the environmental media and biotransform the toxic contaminants to less toxic or non-toxic metabolites. For example, *Datura innoxia* (Jimson weed) grown in cell cultures was able to decolorize "pink water" over night, removing TNT from greater than 100 ppm to undetectable levels. A wild tomato species, *Lycopersicon peruvianum*, was also found to rapidly (within 24 hours) biotransform TNT in cell cultures. Greenhouse studies of whole plants of these species confirmed these results. Plants were grown in soil contaminated with TNT in concentrations of 100, 150, 250, 500, 750, 1000 ppm. Mueller et al. (1995) reported that plants grew well in soils with TNT levels up to 500 ppm, with slight detrimental effects in both *Datura* and *Lycopersicon*.

observed at 750 ppm, and moderate stress in the *Lycopersicon* plants and slight effects on the *Datura* plants at 1,000 ppm. At the lower concentrations of TNT in soil, more of the contaminant was translocated from the roots into stems and leaves as compared to the higher concentrations (i.e., 500 ppm or more). Mueller et al. (1995) reported that no TNT was translocated into the aboveground parts of either species, and even in the roots at least 99% of the contamination detected was present as metabolites.⁸ In another study, Kim and Drew (2004) evaluated the uptake and phytotoxicity of TNT in onion plants grown hydroponically. These researchers found that of total TNT mass, 75% was in the roots, 4.4% in the leaves, and 21% in the external solution after two days. The percent distribution in roots was lower with higher concentrations of TNT, but in leaves it was comparable in all concentrations.⁹ Gong et al. (1999) evaluated seed germination and early stage seedling growth tests of two dicotyledons (*Lepidium sativum* L., cress, and *Brassica rapa* Metz, turnip) and two monocotyledons (*acena sativa* L., oat, and *Triticum aestivum* L., wheat). The cress and turnip plants showed higher sensitivities to TNT than the oat and wheat plants. In contrast to high TNT concentrations, at low levels of TNT in this study (i.e., 5-25 ppm for cress and turnip and 25-50 ppm for oat and wheat), seedling growth was stimulated. Oat was capable of tolerating as much as 1,600 ppm TNT.¹⁰

The maximum TNT surface soil value observed in the Firehole area (i.e., 1,300 ppm) is within the range of values tested in the above studies. Based on this review, it appears that TNT in the soils at this site would not be present in the edible portions of the crops grown at this site.

ATSDR also consulted with a subject matter expert, Dr. Mark Johnson, on TNT toxicity and plant uptake. Dr. Johnson has experience at TNT-contaminated sites nationwide. He is a member of the Tri-Service Ecological Risk Assessment Work Group, which coordinates and develops uniform technical guidance for the conduct of ecological risk assessments within the military community, and he has developed toxicity data for munitions compounds to support toxicity reference value derivations for wildlife.¹¹¹² Dr. Johnson confirmed that concentrations of TNT in plants grown in TNT-contaminated soils should be insignificant.¹³

Therefore, ATSDR concludes that although there is most likely variability in the uptake and biotransformation of nitrosamine compounds in different species of plants, we do not expect adverse human health effects resulting from exposure through consumption (human or animal) of crops grown in nitrosamine-contaminated soils at this site.

Extra precautions may be warranted for some crops grown in soils contaminated with lead at greater than 400 ppm, particularly root crops or low-growing plants that may accumulate the contaminated soil on their edible portions. However, given that there was only one surface soil result with lead greater than 400 ppm in the Firehole portion of this site, we did not consider this a concern for crops grown in this area of the site.

Evaluation of Future Residential Pathway

Figure 4 depicts a proposed development plan for the Elkton Farm site. In this plan, none of the proposed housing units are located directly in the Firehole portion of the site.

According to the EPA, existing local public water supplies may not be sufficient to meet the needs of the proposed large residential development at this site. A private water system may need to be developed for the proposed complex using local surface or ground water supplies. This system may involve the development of new groundwater supplies or a surface water supply. Therefore, the drinking water pathway is a potential future route of exposure at this site.

Note, any private water supply developed for this site would most likely fall under the auspices of the Safe Drinking Water Act and its mandates for maximum levels of contaminants.

Nevertheless, the future drinking water pathway at this site cannot be fully evaluated at this time, because a water supply option has not yet been chosen (and therefore no specific sampling results for this pathway are available for review).

A few chemicals were detected above screening values in surface soil from the Firehole portion of the site. However, EPA and MDE have indicated that removal activities will occur under CERCLA at the Firehole portion of the site. These activities will involve efforts to remove elevated levels of nitroaromatic compounds in soil, as well as unexploded shell detonators, rocket motors, and other materials that pose physical hazards. Furthermore, current proposals for the site indicate that the developers may use the Firehole portion of the site for stormwater management wetland areas after the hot spot areas have been removed (see Figure 4). Therefore, after consideration of likely non-residential future exposure scenarios in this area of the site, and because removal activities are anticipated in the Firehole area, ATSDR does not expect adverse health effects to result from exposure to *residual* post-removal action contamination at the surface of the Firehole area. Contamination at soil depths was not evaluated in this document. If development plans at this site eventually involve the excavation of this portion of the site, further consideration of possible worker exposure scenarios would be warranted.

ATSDR is unable to comment on the possibility of vapor intrusion as potential exposure pathway to future residents at this time. Because there is a plume of VOC-contaminated groundwater at this site, and the depth to groundwater is expected to be ~20 feet, this pathway will need to be evaluated further if development plans proceed at this site.

It is important to note that ATSDR's conclusions regarding exposures to future residents at this site are limited by two major factors: (1) we do not know the actual specifics for the future development at this site (e.g., source and quality of drinking water that will be supplied to residents, specific locations of future residences, construction characteristics of future residences, fill material that may be placed in residential areas, etc.). Furthermore, the entire 400-acre property is very large, and ATSDR only reviewed environmental data for the 32-acre Firehole portion. MDE and EPA have indicated that the nature and extent of contamination will be further evaluated over the 400-acre property and that these data will be shared with ATSDR for a public health review.

Child Health Considerations

Children are of concern at this site, because children can be assumed to be consuming crops from this site, and may also be expected to be residents in the future proposed development at the site.

ATSDR considered child-specific doses in our screening of the sampling data from this site.

The many differences between children and adults demand special consideration. Children can be at greater risk than are adults from certain kinds of exposure to hazardous substances. Children play outdoors and often use hand-to-mouth behaviors that increase their exposure potential. Children are shorter than are adults. This means they breathe dust, soil, and vapors close to the ground. Children are smaller than adults which results in a greater dose of a substance per unit of body weight. If toxic exposure levels are high enough during critical growth stages, the developing body systems of children can sustain permanent damage. Finally, children are dependent on adults for access to housing, for access to medical care, and for risk identification.

Conclusions

ATSDR has determined that the Elkton Farm Firehole site poses *no apparent public health hazard* for current consumption of crops from the site. ATSDR concludes that the Elkton Farm Firehole site poses an *indeterminate public health hazard* for the future development of the site, because assessment of overall future residential exposures is not possible at this time.

- Based on the current data, ATSDR does not expect adverse human health effects from consumption of crops grown in the 32-acre Firehole area.
- ATSDR does not expect that chemical concentrations in surface soil from the Firehole portion of the site will pose a public health concern for adults or children residing near or visiting the Firehole portion of the site in the future, if appropriate measures (e.g., the proposed removal actions) are taken to eliminate contact with the elevated areas of contamination identified in the various sampling investigations. EPA and MDE have stated that removal activities will occur under CERCLA at the Firehole portion of the site, including efforts to remove elevated levels of nitroaromatic compounds in soil, unexploded shell detonators, rocket motors, and other materials that pose physical hazards.
- There are significant unknowns regarding future development of this site, particularly with respect to the potential for exposure from drinking water, subsurface contamination, and vapor intrusion. Further evaluation is necessary to ensure that all public health issues are addressed if development plans proceed.

Recommendations

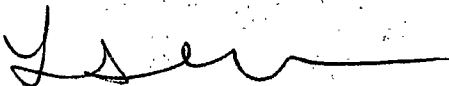
- ATSDR recommends that removal activities continue at the Firehole portion of the site to address the elevated levels of compounds in soil, as well as unexploded shell detonators, rocket motors, and other materials that pose physical hazards.
- Because site-related contamination was found in groundwater samples from this site, ATSDR recommends that drinking water supply options for the proposed residential development be carefully and comprehensively evaluated.

- Because there is a plume of VOC -contaminated groundwater at this site, and the depth to groundwater is expected to be approximately 20 feet, ATSDR recommends that the potential for vapor intrusion be evaluated further (e.g., soil gas monitoring) if development plans proceed at this site.
- ATSDR recommends that, prior to development, public health review of the entire site be conducted after additional environmental data are available.

ATSDR's conclusions and recommendations are based upon the available information. If additional or new information becomes available, ATSDR is available to review the information and provide a determination as to the public health significance.

Preparers of Report:

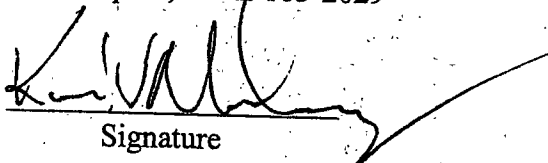
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Figure 1. Sample Location Map, Elkton Farm Firehole Area, October 2002 and May 2003 Sampling Events.

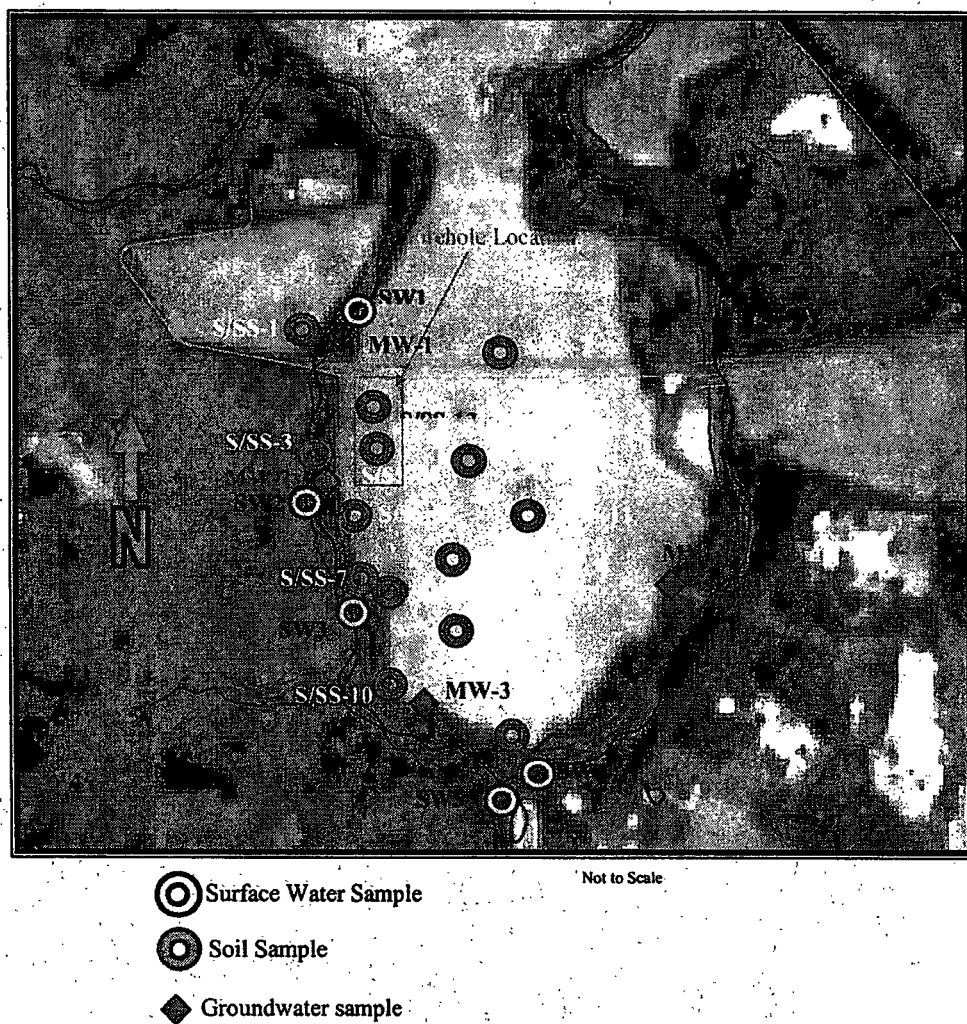
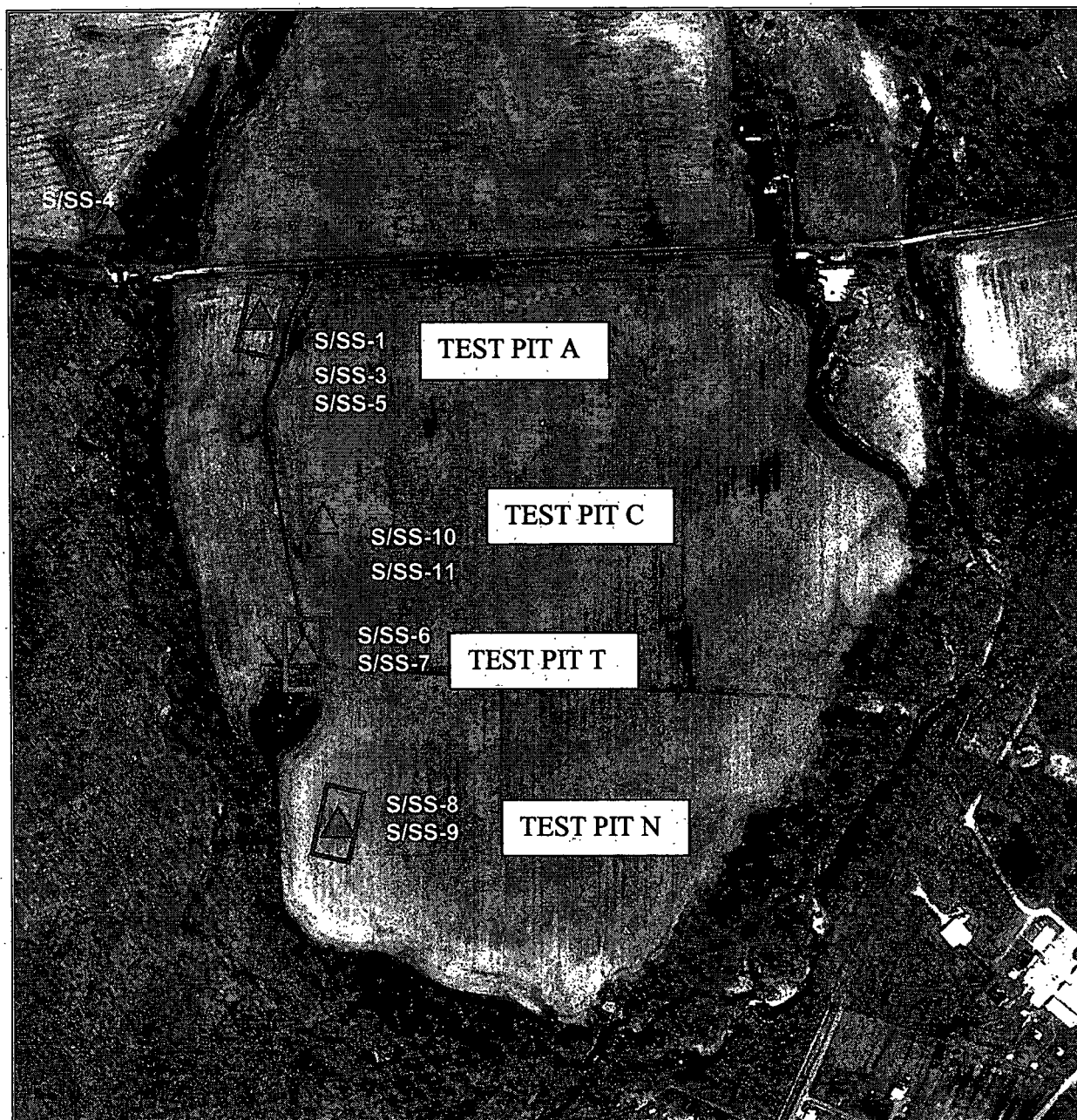


Figure 2. Sample Location Map for Elkton Farm Firehole Area, December 2004-January 2005 Sampling Event.

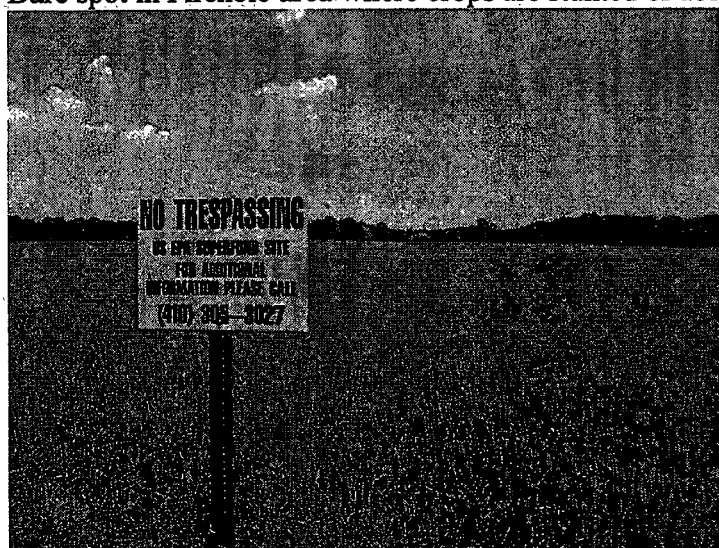


Note – triangles indicate locations of test pits in Firehole area.

Figure 3. Photographs from June 8, 2005 Site Visit to Elkton Farm Site



Bare spot in Firehole area where crops are stunted or absent.



Overlook of farm and EPA signage.



Close up of barren area and ordnance relic.



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- ⁶ U.S. EPA Organic Data Validation Report for the Elkton Farm Site. Submitted from Khin-Cho Thaung, Region 3 ESAT RPO to Lorie Baker, EPA Site Assessment Manager, January 31, 2005.
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- ¹¹ U.S. Army Center for Health Promotion and Preventive Medicine. Wildlife Toxicity Assessment for 2-amino-4,6-dinitrotoluene and 4-amino-2,6-dinitrotoluene. Key Technical Authors, George Holdsworth, PhD and Mark S. Johnson, Ms, PhD. December 2001. USCHPPM Document No: 39-EJ-1138-01D.
- ¹² U.S. Army Center for Health Promotion and Preventive Medicine. Wildlife Toxicity Assessment for 2,4,6-trinitrotoluene (TNT). Key Technical Author, Mark S. Johnson, Ms, PhD. October 2000. USCHPPM Document No: 39-EJ-1138-00.
- ¹³ Personal conversation. Dr. Mark Johnson, Environmental Toxicology, Health Effects Research Program, U.S. Army Center for Health Promotion and Preventive Medicine, with Dr. Karl Markiewicz, ATSDR Region 3, May 2005.